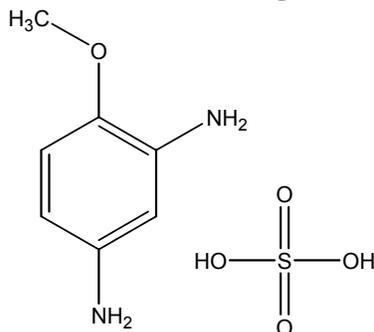


2,4-DIAMINOANISOLE SULFATE

CAS No. 39156-41-7

First Listed in the *Third Annual Report on Carcinogens*



CARCINOGENICITY

2,4-Diaminoanisole sulfate is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1978, 1982, 2001). When administered in the diet, 2,4-diaminoanisole sulfate increased the incidences of thyroid follicular cell adenomas in mice of both sexes and thyroid follicular cell carcinomas in female mice. When administered in the diet to rats, 2,4-diaminoanisole sulfate increased the incidences of squamous cell carcinomas, basal cell carcinomas, or sebaceous adenocarcinomas of the skin and its associated glands; malignant thyroid follicular cell tumors; and preputial or clitoral gland adenomas, papillomas, or carcinomas in rats of both sexes; further, thyroid C-cell adenomas or carcinomas and Zymbal gland squamous cell carcinomas or sebaceous adenocarcinomas were observed in male rats (NCI 1978). In another study, when administered in the diet to female rats, 2,4-diaminoanisole sulfate induced mammary adenocarcinomas and carcinomas of the clitoral gland and increased the incidences of follicular cell adenomas or carcinomas and C-cell carcinomas of the thyroid (IARC 1982).

No adequate data were available to evaluate the carcinogenicity of 2,4-diaminoanisole sulfate in humans (IARC 2001).

PROPERTIES

2,4-Diaminoanisole sulfate is an off-white to violet powder. It is soluble in water and ethanol. The commercial grade used in the United States was available as the dihydrate with a minimum purity of 80% (IARC 1978). It is reactive with strong oxidizers and is sensitive to prolonged exposure to air. When heated to decomposition ($\geq 189^{\circ}\text{C}$), it emits very toxic fumes of nitrogen oxides and sulfur oxides (HSDB 2001, NTP 2001).

USE

2,4-Diaminoanisole sulfate is used primarily as a component of oxidizing "permanent" hair- and fur-dye formulations. In 1978, approximately 75% of the hair-dye formulations contained 2,4-diaminoanisole or its sulfate. These two compounds are also intermediates in the production of C.I. Basic Brown 2, which is used to dye furs, acrylic fibers, cotton, wool, nylon, polyester, and leather and suede and is an ingredient of shoe polishes (IARC 1978, 1982). 2,4-Diaminoanisole sulfate is not presently used in consumer products under the Consumer Product Safety Commission (CPSC) jurisdiction, but it is a component of cosmetic products.

PRODUCTION

Commercial production of 2,4-diaminoanisole sulfate in the United States was first reported to the U.S. Tariff Commission in 1967, but no production has been reported since 1971 (IARC 1978). No current data regarding production, export, or import of 2,4-diaminoanisole sulfate in the United States were located. Chem Sources identified two U.S. suppliers of 2,4-diaminoanisole sulfate in 1990 (Chem Sources 1991), and Chem Sources (2001) identified five U.S. suppliers. The 1997 *Directory of Chemical Producers* did not list the chemical (SRI 1997). The *Directory of Chemical Producers* reported that one U.S. company produced an unknown quantity of 2,4-diaminoanisole sulfate in 1986 (SRI 1986). In 1979, EPA reported two producers and importers. Domestic production data were not available, but the import estimate was 350 lb. The 1979 TSCA Inventory identified one domestic producer of 2,4-diaminoanisole sulfate in 1977, with no volume reported, and one company importing 500 lb (TSCA 1979).

EXPOSURE

The primary routes of potential human exposure to 2,4-diaminoanisole sulfate are dermal contact and inhalation. Potential consumer exposure could occur for persons using hair dyes containing 2,4-diaminoanisole sulfate. The maximum concentration of the compound in hair-dye preparations is approximately 1.5%. Potential occupational exposure could occur for workers at chemical- and dye-production facilities, as well as workers using dyes containing 2,4-diaminoanisole sulfate to dye furs, leather, and textiles. Potential exposure of hairdressers and cosmetologists could occur while using hair dyes containing 2,4-diaminoanisole sulfate. In a 1978 report, NIOSH made no estimate of the potential worker exposure to the sulfate, but an estimated 400,000 workers were possibly exposed to 2,4-diaminoanisole. Hairdressers and cosmetologists made up the largest portion of this group (IARC 1982). According to NCI (1978), substantial exposure of the general population to 2,4-diaminoanisole sulfate is questionable.

REGULATIONS

2,4-Diaminoanisole sulfate is subject to reporting requirements under the Toxic Substances Control Act (TSCA) and the Superfund Amendments and Reauthorization Act (SARA).

FDA regulates 2,4-diaminoanisole sulfate as a component of hair dyes and requires a warning label on cosmetic products containing the chemical. However, a court decision stayed the FDA regulation, pending determination of the potential human health risk from dermal exposure to the compound. FDA is continuing its consideration of the matter.

NIOSH recommends that exposure be reduced to the lowest feasible concentration. OSHA regulates 2,4-diaminoanisole sulfate under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 56.

REFERENCES

Chem Sources USA. 32nd Edition. Ormond Beach, FL: Directories Publishing Company, Inc., 1991.

Chem Sources. Chemical Sources International, Inc. <http://www.chemsources.com>, 2001.

HSDB. Hazardous Substances Data Bank. Online database produced by the National Library of Medicine. 2,4-Diaminoanisoole Sulfate. Profile last updated August 9, 2001. Last review date, November 30, 1992.

IARC. International Agency for Research on Cancer. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Some Aromatic Amines and Related Nitro Compounds – Hair Dyes, Colouring Agents and Miscellaneous Industrial Chemicals. Vol. 16. 400 pp. Lyon, France: IARC, 1978.

IARC. International Agency for Research on Cancer. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Some Aromatic Amines, Anthraquinones and Nitroso Compounds, and Inorganic Fluorides Used in Drinking Water and Dental Preparations. Vol. 27. 341 pp. Lyon, France: IARC, 1982.

IARC. International Agency for Research on Cancer. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Some Thyrotropic Agents. Vol. 79. 763 pp. Lyon, France: IARC, 2001.

NCI. National Cancer Institute. Carcinogenesis, Technical Report Series No. 84. Bioassay of 2,4-Diaminoanisoole Sulfate for Possible Carcinogenicity (CAS No. 39156-41-7). DHEW (NIH) Publication No. 78-1334. 69 pp. National Institutes of Health, Bethesda, MD, 1978.

NTP. National Toxicology Program. NTP Chemical Respository, 2,4-Diaminoanisoole Sulfate. Last Updated August 13, 2001. (<http://ntp-server.niehs.nih.gov> and search 39156-41-7).

SRI. Directory of Chemical Producers, United States, 1985. Stanford Research Institute, Menlo Park, CA: SRI International, 1986.

SRI. Directory of Chemical Producers, United States, 1997. Stanford Research Institute, Menlo Park, CA: SRI International, 1997.

TSCA. Toxic Substances Control Act, Chemical Substance Inventory, 1979: public record.